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GEORGE C. MARSHALL SPACE FLIGHT CENTER

HUNTSVILLE, ALABAMA

TEST RESULTS PART I of the FIRING TEST REPORT SATURN VEHICLE SA-1 (U)

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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TEST RESULTS
PART I
of the
FIRING TEST REPORT
SATURN VEHICLE SA-1

REPORTS AND PUBLICATIONS SECTION

(C) ABSTRACT

The Saturn Vehicle SA-1, consisting of the S-I booster, S-IV dummy second stage, S-V dummy third stage, and dummy payload body, was launched from Atlantic Missile Range, Complex 34 at 1006 hours EST on October 27, 1961. The flight appeared normal and all of the test objectives were satisfactorily performed.

The vehicle's trajectory was approximately as planned with a launch and flight azimuth of 100 degrees east from true north, and a range of 196.2 nautical miles. This report includes a summary of test results, test objectives, and a history of the vehicle at AMR.

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MTP-LOD-61-36.1

TEST RESULTS
PART I
of the
FIRING TEST REPORT
SATURN VEHICLE SA-1 (U)
AMR TEST NR. 4508

By

Reports and Publications Section

[redacted]

TECHNICAL INFORMATION BRANCH
LAUNCH OPERATIONS DIRECTORATE

LAUNCH OF SATURN VEHICLE SA-1

TABLE OF CONTENTS

INTRODUCTION

(U) This report, Part I of the Firing Test Report, includes a summary of test results, test objectives, trajectory data, and a detailed breakdown of the Saturn Vehicle SA-1 systems performance during flight. The countdown is reviewed and a history of the vehicle while at Cape Canaveral is given.

(C) The Saturn Vehicle SA-1, consisting of the S-I booster, S-IV dummy second stage, S-V dummy third stage, and dummy payload body, was approximately 162 feet long and had an approximate liftoff weight, including propellants (liquid oxygen and RP-1 fuel) of 926,308 pounds. Eight H-1 rocket engines, having a thrust of 165,000 pounds each, propelled the SA-1 vehicle into a ballistic trajectory.

(C) Instrumentation on board the SA-1 Vehicle included a measuring system for monitoring propulsion, temperature, pressure, strain and vibration, etc; a telemetering system, containing eight telemetry links; and an antenna system, including four continuous lights, three command antennas, two UDOP antennas, three S-band radar antennas, one Azusa antenna, one C-band antenna and six telemetry antennas.

(U) The complete Firing Test Report includes plans and procedures for launching the vehicle, evaluating vehicle performance, collection of flight data and presentation of test results by Launch Operations Directorate personnel. The complete report is published in six parts and is distributed as soon as the information is available. The parts of the report are Part I, Test Results; Part IIa, Consolidated Instrumentation Plan; Part IIb, Instrumentation Operations Analysis; Part III, Firing Site Weight Report; (not to be published for SA-1); Part IV, Launch Countdown; and Part V, Unsatisfactory Condition Reports.

(C) SUMMARY OF TEST

Saturn Vehicle SA-1 was successfully launched from Complex 34 at 1006 hours EST on October 27, 1961.

The scheduled ten-hour countdown began at 2300 hours EST, October 26, 1961. No technical difficulties requiring holds were experienced during the countdown, but two holds were called because of low clouds over the launch area. Automatic fueling and sequencing processes were satisfactorily conducted. Compatibility of the ground support equipment and the flight vehicle was demonstrated. Close-up photographs of the launcher arms and vehicle revealed severe undulations of the outboard engine shroud during the holddown period and at lift-off; however, neither the vehicle nor the launcher arm performance was adversely affected.

Overall performance of the booster during flight was highly satisfactory. Wind shear encountered near the region of maximum dynamic pressure resulted in a 4-1/2 degree engine deflection and a visible alteration of the flight path, but the disturbance was handled by the control system with no difficulty. The propulsion system performed satisfactorily throughout the flight and structural integrity of the vehicle was demonstrated.

(C) TRAJECTORY

Precalculated Trajectory Data

The precalculated trajectory for the Saturn Vehicle SA-1 is presented in: Report Nr. MTP-AERO-61-72 entitled "Saturn C-1 vehicle, SA-1 Test Flight Trajectory Corridor to be flown by SA-1" (U), dated August 31, 1961, by MSFC, NASA, Huntsville, Alabama (CONFIDENTIAL).

Launch Site

The vehicle was launched from Complex 34, Cape Canaveral Missile Test Annex, Atlantic Missile Range, Florida, on an azimuth of 100.00 degrees east from true north.

Vehicle Impact Point

The predicted impact range was 196.2 nautical miles (363.3 km). Actual impact was approximately 12 nautical miles short because of premature inboard engine cutoff. The low level cutoff sensor in fuel tank number 2 generated a premature cutoff signal as a result of fuel sloshing.

(C) SIGNIFICANT FLIGHT TEST EVENTS

Times of Events

The functional times of the significant events which occurred during ignition and flight are listed below:

Times listed under "Predicted" were precalculated by Aero-ballistics Division and are given for reference and comparison with the actual times which were obtained by a preliminary evaluation of uprange telemetry records. All ignition values and flight times are listed in seconds, prior to or after liftoff, as indicated.

	Predicted (sec. prior to liftoff)	Actual (sec. prior to liftoff)
Ignition Command	3.77	3.97
Engine Nr. 5	3.755	3.96
Engine Nr. 7	3.755	3.96
Engine Nr. 6	3.655	3.86
Engine Nr. 8	3.655	3.86
Engine Nr. 2	3.555	3.75
Engine Nr. 4	3.555	3.75
Engine Nr. 1	3.455	3.66
Engine Nr. 3	3.455	3.66
Range Zero	1006 Hours 3 Seconds EST	
Liftoff	1006 Hours 3.93 Seconds EST	
	Predicted (sec. after liftoff)	Actual (sec. after liftoff)
Cutoff - Inboard Engines	111.1	109.37
Cutoff - Outboard Engines	117.1	115.15
Loss of Telemetry Signal (Hangar D)	—	408.42

Onboard Instrumentation and Telemetry Measurements

All eight links performed correctly throughout the entire flight (approximately 410 seconds), with the exception of link Nr. 3 which had an incorrect in-flight calibration. Only a few measurements were lost or yielded incorrect or doubtful data.

All RF systems performed satisfactory. Good tracking data can be expected.

SA-1 VEHICLE PERFORMANCE

(C) Airframe (structural)

The booster S-I structural integrity was satisfactorily maintained throughout powered flight.

(C) Propulsion System

General

Performance of the propulsion system was very good. Indications are that ignition, transition, mainstage, and cutoff were as expected with the measured combustion chamber pressures showing no hint of major deviations. Inboard engine cutoff occurred earlier than predicted, but preliminary evaluation indicates this to be due primarily to sloshing amplitudes rather than performance deviations of the engines. This would indicate that the mixture ratio and total flow rate were reasonably close to predicted values. Inboard engine cutoff was given by the low level cutoff sensor located in fuel tank number 2. All individual thrust decays appear to have been extremely smooth and in good agreement with each other. Consequently, the vehicle experienced practically no disturbance torques at cutoff and continued to fly without pronounced tumbling motion through loss of signal from uprange.

Thrust Chamber Dome Vibration

Since rough combustion cutoff was not required and the flight was normal, the thrust chamber dome vibration level was negligible.

(C) Guidance and Control System

Inertial measurements in slant range, slant altitude and cross range indicate that the vehicle performed normally during flight. Cutoff, initiated by propellant measurement, was approximately two seconds earlier than expected (according to Aeroballistics Report Nr. MTP-AERO-61-72). Therefore, the slant range and slant altitude velocity at cutoff were accordingly lower. Crossrange measurements indicate that the vehicle had a velocity of approximately five meters per second to the left, at telemeter dropout.

The control system performed normally. Engine deflections of approximately 4 1/2 degrees were demanded during the high dynamic pressure region, as predicted for the existing winds aloft. Slight oscillations of approximately 1 1/2 cycles

per second appeared in the control loop approximately fifteen seconds before cutoff. These oscillations were also indicated by other measurements. The stabilizer system ST-90 functioned normally. Network operations were as expected. No discrepancies were detected on the records at this time.

(U) Fire Detection During Holddown

The flame shield, heat shield, and firewall appeared to provide adequate protection, since no fires were detected during ignition, holddown, and liftoff.

The fire detection and water quench system was not required, since no fires developed.

(C) GROUND SUPPORT EQUIPMENT PERFORMANCE

General condition of the ground support equipment is better than expected. Only the minor damage normally sustained for a flight of this nature was experienced.

Service Structure

The operation of the service structure during the countdown was satisfactory. During vehicle liftoff, the service structure sustained only superficial damage, mainly the pushing in and blowing out of several "blow out" panels in the service structure base buildings.

Launcher (during countdown and holddown)

Umbilical Connections

Short Cable Mast Assembly

Short cable masts Nr. 2 and Nr. 4, and tail cable masts Nr. 2 and Nr. 4, performed satisfactorily. Short cable masts Nr. 2 and Nr. 4 disconnected cleanly at thrust commit plus 107 milliseconds. The tail cable masts separated satisfactorily with vehicle motion. These four items suffered approximately 10 percent damage with the exception of the electrical cables which are not reusable items.

Long Cable Mast Assembly

The long cable mast performed satisfactorily. It disconnected clearly on command and reached the retracted position in 17.3 seconds. The base supports fractured shortly after liftoff and the mast fell to the ground, sustaining approximately 90 percent damage with the exception of the electrical cables which are not reusable and the liquid nitrogen cooler which is apparently reusable.

Fuel and LOX Filling Mast Assemblies

The fuel and LOX filling mast assemblies suffered approximately 10 percent damage. Their performance at liftoff has hot been evaluated because the photographic coverage required for evaluation is not available at this time.

Retractable Support Arms

The retractable supports performed satisfactorily as indicated by the available records. They operated the 3/4-inch switches at times varying from 330 milliseconds to 347 milliseconds after thrust commit. They are apparently reusable, but time has not permitted the evaluation necessary to determine the rework required.

Holddown Arms

The holddown arms performed satisfactorily as indicated by the available records. The damage sustained was apparently superficial.

Heat Protection

Cameras on top the launch pedestal and under the torus ring were adequately protected, using Dynatherm paint.

Flame Deflector

The general condition of the flame deflector is good. Only minor damage was found which consisted of a slight amount of metal flow and erosion, and some structural warpage which appears to be of little consequence.

Propellant Loading

Loading and Replenishing Systems

A. The fuel tanks were filled to approximately 103 percent by dialing a $\pm$ 0.355 PSI correction into the computer. After liquid oxygen was loaded the fuel density remained within the specified limit of 0.3 percent. Therefore, the replenishing system was not required, only a level drain adjustment at T-90 minutes.

B. The liquid oxygen tanks were filled to 100 percent (no correction was dialed into the computer on filling). After the fuel adjust level drain was made, a correction of $\pm$ 0.105 PSI was dialed into the computer and the replenish system topped the tank level to 100 percent. This level was maintained by replenishing periodically. The backup manometer and the computer were within the specified tolerance of 0.15 percent (computer corrected ΔP=16.550 PSI, manometer ΔP=16.563 PSI).

C. The fuel (RP-1) was thoroughly circulated and filtered prior to L-1

day and samples were taken from various locations in the system, one sample for chemical analysis and four samples for a specific gravity check.

1. The chemical analysis was performed by the Chemical Laboratory and the gravity checks were by LOD personnel. The average specific gravity was 0.801 @ 74 degrees F. on L-1 day. The vehicle was loaded to a 10 percent full level in a manual, slow fill sequence at a rate of approximately 200 gallons per minute, to allow a leak check of the RP-1 system.

2. Upon completion of the system leak check, the vehicle was filled to 100 percent ≠ with the automatic fill sequence. A "course" adjust level drain was made by adding 1.0 percent to the fuel density digital readout and dialing into the computer, a correction factor corresponding to that density (98.87 percent ≠ 1.0 percent = 99.87 percent, correction = - 0.015 PSI).

3. A final adjust level was made at T-90 minutes after the fuel density had stabilized to 98.82 percent (correction factor = - 0.165 PSI). The density increased slightly during the remainder of the count to a final valve of 98.90 percent of the 11.400 PSI differential pressure set into the computer.

D. The vehicle liquid oxygen tanks were filled to 10 percent full to allow leak checking the vehicle and transfer system. This was accomplished in the pre-cool sequence by using pressure from the main storage tank. The level was maintained by the replenish system after the 75 percent and 98 percent signals were jumpered in, and the electrical connector was removed from the throttling valve. The replenish flow was controlled by opening and closing the replenish-by-pass-valve manually. The system was in this replenish condition for approximately four hours.

1. Prior to fast filling the vehicle to 100 percent, the 75 percent and 98 percent jumpers were removed and the throttling valve reconnected.

2. The vehicle loading was completed in the automatic sequence to 100 percent (16.445 PSI).

3. The final liquid oxygen level adjustment was made after the fuel adjust level drain and the liquid oxygen tanks were replenished as stated in paragraph B.

Deviation

The fuel filling sequence was slightly altered by going into slow fill at 97 percent by use of the slow fill push button rather than proceeding automatically at 98 percent. This procedure was decided upon due to the uneven filling of the fuel tanks which causes cycling between fast fill and slow fill.

Malfunctions

A. The fuel mast vacuum breaker leaked when fuel system was filled for a leak check. Evidently the breaker did not reseat after a line drain sequence.

B. A small amount of fuel overflowed from the air removal valve in the fuel replenish and drain line during the adjust level drain on L-1 Day.

C. The liquid oxygen vaporizer blower, for the main tank pressurizing system, cut off. This was apparently caused by overloading the circuit breakers due to icing of the heat exchanger. Since, the main tank pressure exceeded the minimum tank pressure, the count was not delayed.

D. Shortly after the main tank blower cutoff, the replenish vaporizer blower cut off for the same reason as the main tank blower. The replenish tank was fully pressurized and the count was not delayed.

E. The main tank vaporizer heat exchanger developed three liquid oxygen leaks where the fin tubes are welded to the top header. This condition was discovered after the launch.

F. The fuel level manometer transformer burned out and manometer was inoperative on launch day.

Ground Instrumentation

Tracking Systems

A. Fixed Cameras

Good coverage was obtained from launch to approximately 20 seconds.

B. Theodolites

Track was good from launch to 107.5 seconds.

C. Azusa

Track was good from 12.6 to 398.5 seconds.

D. Radar

Good track was maintained from launch to 412 seconds.

Telemetry Systems

Good signal was recorded from launch to approximately 410 seconds.

Engineering Sequential Optics

Number of cameras operated: 65

Number of camera failures: 2 — Cameras 1.2-25 and 1.2-47 obtained no coverage.

Range User Optics

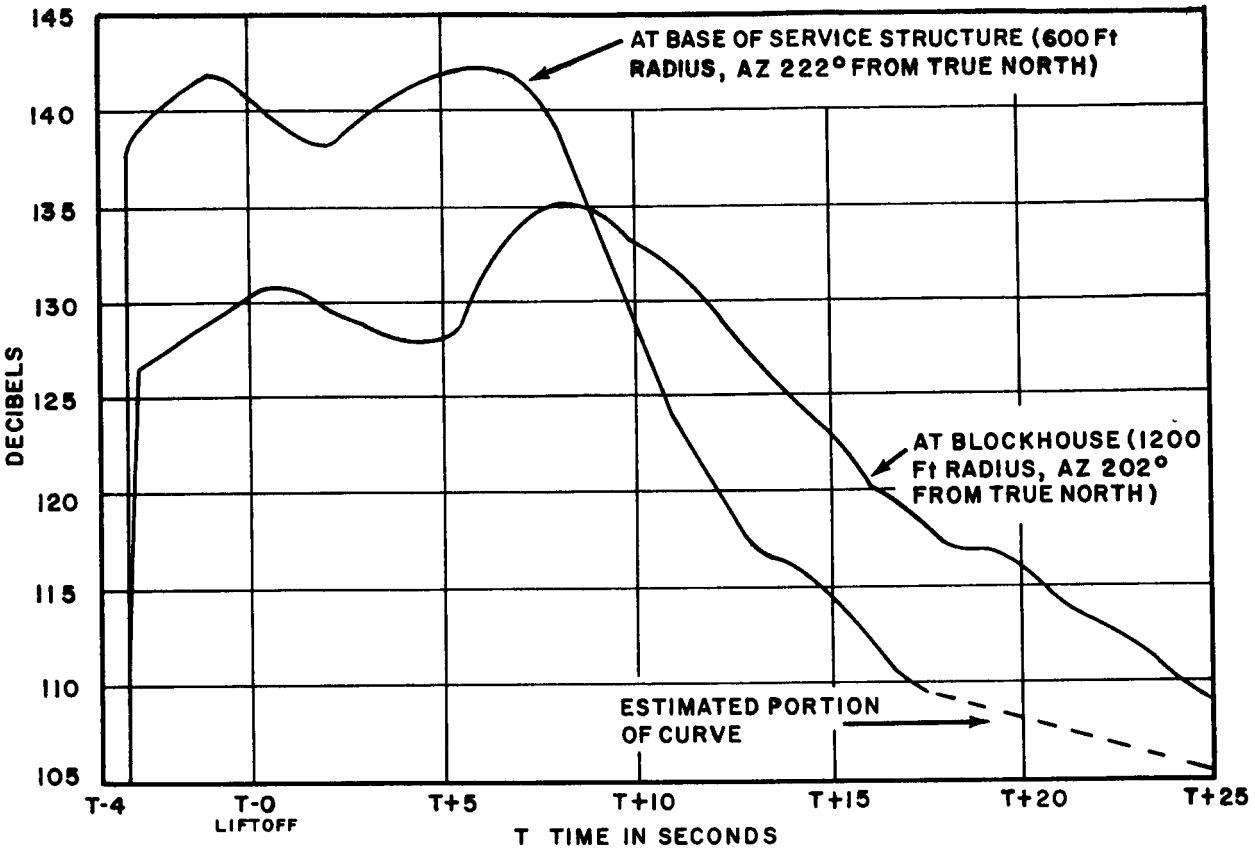
Number of cameras operated: 50

Number of camera failures: 3 — Cameras 1.3-26, 1.3-27 and 1.3-29 obtained no coverage.

(U) ANALYSIS OF GROUND ACCOUSTIC MEASUREMENTS

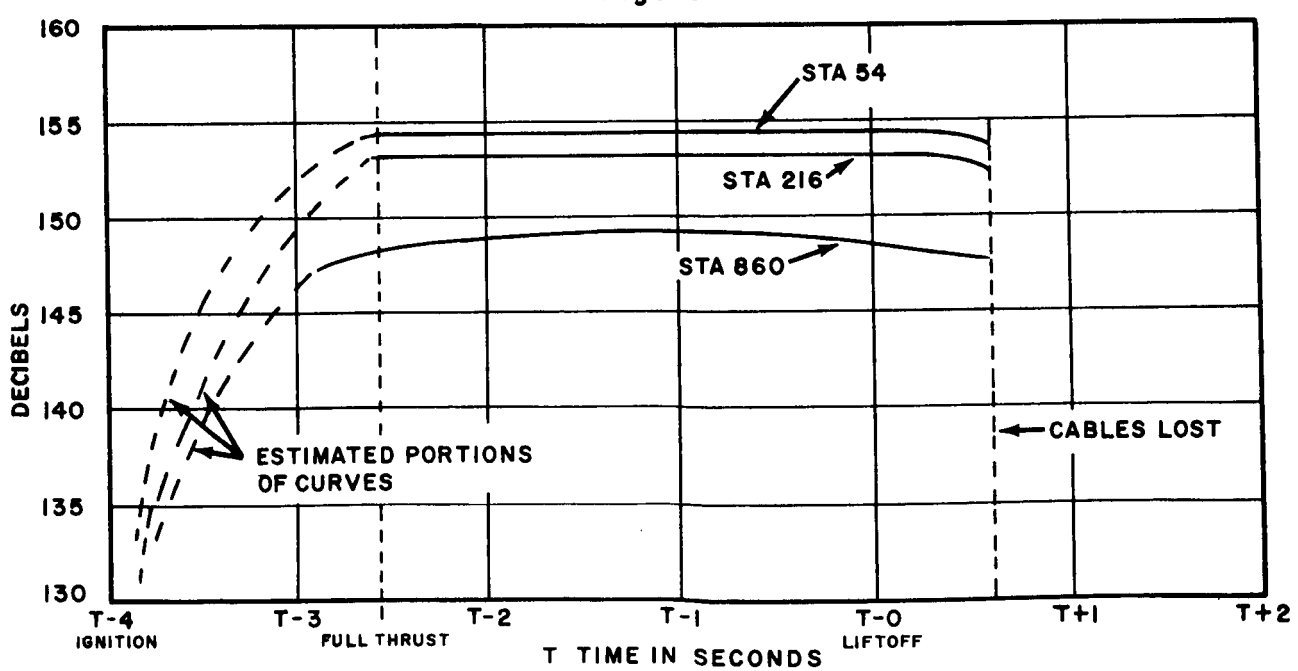
TYPICAL OVERALL SOUND PRESSURE LEVEL VS TIME CHARACTERISTICS FOR SA-1 LAUNCH

Figure 2



TYPICAL SOUND PRESSURE LEVEL VS TIME CURVES IN MIDFIELD

Figure 1



TYPICAL SOUND PRESSURE LEVEL VS TIME CURVES
ON UMBILICAL POLE IN NEAR FIELD (24 Ft FROM VEHICLE)

ROOT-MEAN-SQUARE SOUND PRESSURE LEVEL (RMS SPL) IN DECIBELS REF 0.0002 MICROBAR

COUNTDOWN REVIEW

(C) Schedule

The launch countdown began at T-600 minutes at 2300 hours EST on October 26, 1961 and was continuous except for the following holds:

(C) Holds

A. The first hold was called at T-120 minutes (0700 hours EST) for 34 minutes to await more favorable cloud conditions necessary for photo coverage. The count was resumed at 0734 hours EST.

B. The second and final countdown hold was called at T-20 minutes (0914 hours EST) to again await improved weather conditions. The hold continued for 32 minutes, the count was resumed at 0946 hours EST and continued to launch.

(U) Weather

The general weather conditions at time of launch were considered good. There was no precipitation and the visibility was 10 miles. Only high cumulus clouds existed. The winds, 70 degrees at 14 knots with gusts up to 21 knots, were within the design limitations for vehicle launch. For detailed weather data, refer to Appendix B.

(C) Automatic Countdown

It was determined during the LOX loading test that LOX pressurization took less time than anticipated, therefore, automatic countdown operation began at T-364 seconds prior to Ignition Command instead of T-374 seconds.

The automatic countdown operation was normal except for the loss of the following indications:

1. LOX relief Nr. 1 closed (pen 63) - switch failed.

2. LOX vent closed (pen 66) - switch failed.

3. Three of the four hydraulic pump pressure switches cycled (pens 110, 111, and 112).

The ground sequence of events is listed on the following pages.

(C) GROUND SEQUENCE EVENTS

Event	Pen Nr.	Predicted Time Nominal (sec.)	Actual Time (sec.)
Firing Command	49	−364	−359.79
Fuel Vent Nr. 1 Closed	50	−362	−359.24
Fuel Vent Nr. 2 Closed	51	−362	−359.29
Fuel Pressurizing Command	52	−362	−359.24
Fuel Pressurizing Valve Nr. 1 Open	53	−362	−359.19
Fuel Pressurizing Valve Nr. 2 Open	54	−362	−359.19
Fuel Pressurizing Valve Nr. 3 Open	55	−362	−359.19
Fuel Pressurizing Valve Nr. 4 Open	56	−362	−359.19
Fuel Pressurized	57	−349	−339.97
Open LOX Vent and Relief Nr. 1	61	−115	−112.66
Open LOX Relief Nr. 2	62	−115	−112.66
LOX Relief Nr. 1 Closed	63	−115	Switch Failed
LOX Relief Nr. 2 Closed	64	−115	−111.09
LOX Vent Open	65	−115	−112.36
LOX Vent Closed	66	−115	Switch Failed
LOX Pressurizing Valve Open	67	−115	−112.01
LOX Pressurized	68	− 35	− 35.2
Power Transfer Command	72	− 35	− 35.2
Power Transfer Complete	75	− 35	− 35.13
Long Mast Eject Command	76	− 25	− 25.56
Long Mast Retracted	79	− 2	− 8.25
Ignition Start Timer	81	0.	0.0
Ignition Command	82	0	0.0
Eng. Nr. 5 Igniter Nr. 1 Energized	83	0	≠ .04
Eng. Nr. 5 Igniter Nr. 2 Energized	84	0	≠ .04
Eng. Nr. 7 Igniter Nr. 1 Energized	85	0	≠ .04
Eng. Nr. 7 Igniter Nr. 2 Energized	86	0	≠ .04
Eng. Nr. 6 Igniter Nr. 1 Energized	87	≠.10	≠ .14
Eng. Nr. 6 Igniter Nr. 2 Energized	88	≠.10	≠ .14
Eng. Nr. 8 Igniter Nr. 1 Energized	89	≠.10	≠ .15
Eng. Nr. 8 Igniter Nr. 2 Energized	90	≠.10	≠ .15
Eng. Nr. 2 Igniter Nr. 1 Energized	91	≠.20	≠ .24
Eng. Nr. 2 Igniter Nr. 2 Energized	92	≠.20	≠ .24
Eng. Nr. 4 Igniter Nr. 1 Energized	93	≠.20	≠ .24
Eng. Nr. 4 Igniter Nr. 2 Energized	94	≠.20	≠ .24
Eng. Nr. 1 Igniter Nr. 1 Energized	95	≠.30	≠ .33
Eng. Nr. 1 Igniter Nr. 2 Energized	96	≠.30	≠ .33

(C) GROUND SEQUENCE EVENTS
(Continued)

Event	Pen Nr.	Predicted Time Nominal (sec.)	Actual Time (sec.)
Eng. Nr. 3 Igniter Nr. 1 Energized	97	≠ .30	≠ .34
Eng. Nr. 3 Igniter Nr. 2 Energized	98	≠ .30	≠ .37
All Igniters Energized	99	≠ .30	≠ .37
All Engines Running	114	≠ 2.15	≠ 1.30
Thrust OK Timer	115	≠ 3.30	≠ 3.24
Thrust Commit	121	≠ 3.31	≠ 3.27
Retract Support Timer	139	≠ 3.32	No Operation
Short Mast Nr. 2 Valve Nr. 1 Open	123	≠ 3.32	≠ 3.32
Short Mast Nr. 2 Valve Nr. 2 Open	124	≠ 3.32	≠ 3.32
Short Mast Nr. 4 Valve Nr. 1 Open	125	≠ 3.32	≠ 3.32
Short Mast Nr. 4 Valve Nr. 2 Open	126	≠ 3.32	≠ 3.32
Retract Support Command	129	≠ 3.40	≠ 3.35
Retract Valve Nr. 1 Open	130	≠ 3.40	≠ 3.51
Retract Valve Nr. 2 Open	131	≠ 3.40	≠ 3.51
Retract Valve Nr. 3 Open	132	≠ 3.40	≠ 3.50
Retract Valve Nr. 4 Open	133	≠ 3.40	≠ 3.52
Launch Commit	141	≠ 3.67	≠ 3.62
H.D. Release Valve Nr. 1 Open	144	≠ 3.67	≠ 3.68
H.D. Release Valve Nr. 2 Open	145	≠ 3.67	≠ 3.68
H.D. Release Valve Nr. 3 Open	146	≠ 3.67	≠ 3.68
H.D. Release Valve Nr. 4 Open	147	≠ 3.67	≠ 3.68
Holddown Nr. 1 Released	148	≠ 3.77	≠ 3.69
Holddown Nr. 2 Released	149	≠ 3.77	≠ 3.69
Holddown Nr. 3 Released	150	≠ 3.77	≠ 3.69
Holddown Nr. 4 Released	151	≠ 3.77	≠ 3.69
Support Nr. 1 Not Supporting	135	------	≠ 3.62
Support Nr. 2 Not Supporting	136	------	≠ 3.62
Support Nr. 3 Not Supporting	137	------	≠ 3.61
Support Nr. 4 Not Supporting	138	------	≠ 3.62
Liftoff Nr. 1	153	≠ 3.77	≠ 3.77
Liftoff Nr. 2	154	≠ 3.77	≠ 3.77
Liftoff Nr. 3	155	≠ 3.77	≠ 3.77
Liftoff Nr. 4	156	≠ 3.77	≠ 3.77
Liftoff	157	≠ 3.77	≠ 3.77

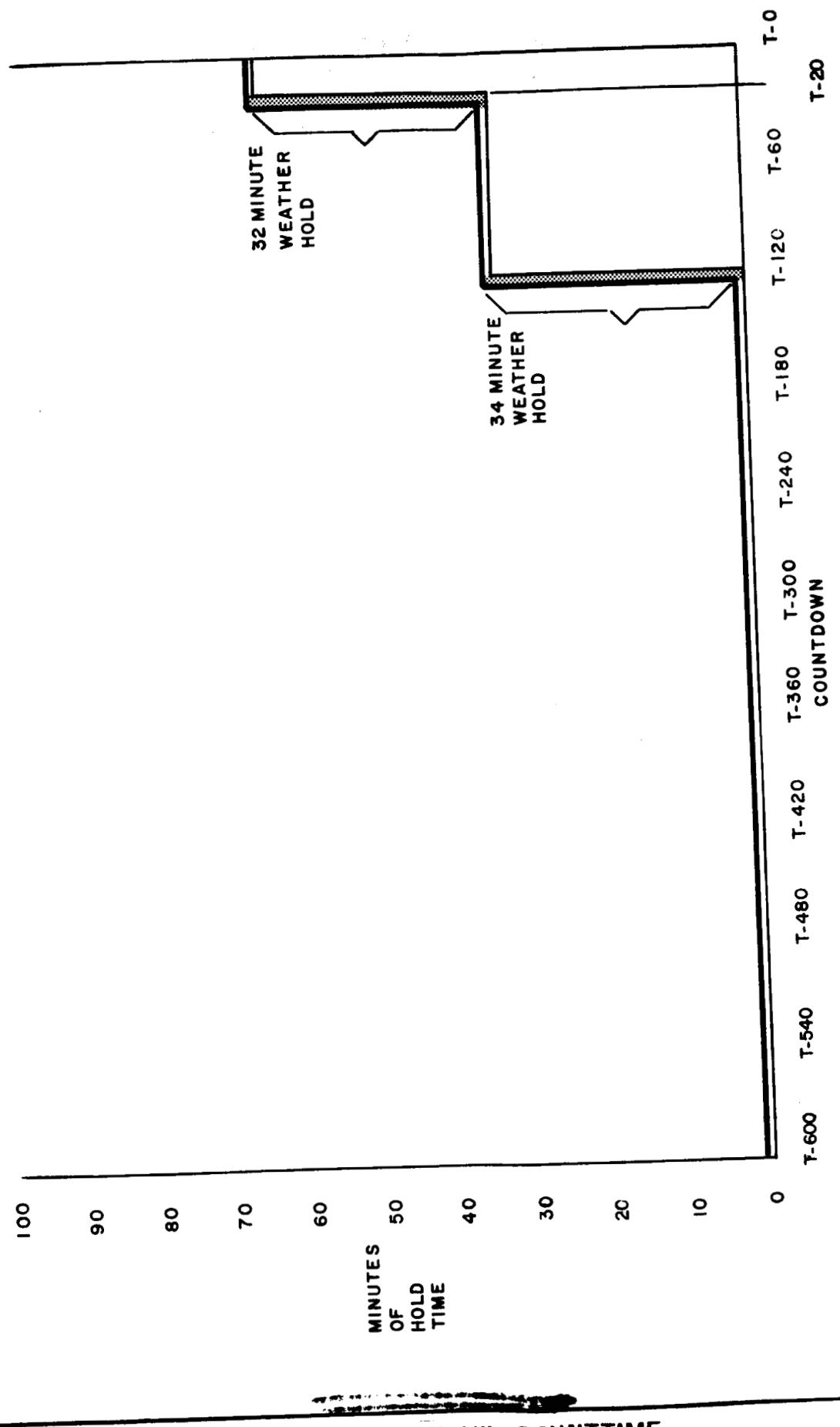


FIGURE 3. HOLDTIME VS. COUNTTIME

(C) APPENDIX A

HISTORY OF SATURN VEHICLE SA-1 AT AMR

Saturn Vehicle SA-1 dummy third stage (S-V) arrived by the barge "Palaemon" at Cape Canaveral on May 1, 1961 and was transferred to Hangar D. The Saturn Vehicle SA-1 booster (S-I), dummy second stage (S-IV), and dummy payload body arrived by the barge "Compromise" on August 15, 1961. The S-I booster was transferred to Complex 34 and the second and third stages were transferred to the Hangar D checkout area the same day. On August 20, 1961, the booster was erected on the launch pedestal.

Following is a chronological account and description of major workload accomplished and milestones passed during the vehicle checkout:

August 21, 1961 thru August 25, 1961 - Cables and cable masts installed. Measuring calibrations, continuity tests, umbilical connections and propulsion leakage tests underway. Retract arms positioned and vehicle power applied. Milestone - S-IV, S-V and nose cone assembled to S-I stage.

August 26, 1961 thru August 30, 1961 - Network power, radio frequency, Azusa transponder, UDOP and antenna checks underway. Accelerometers installed. Propulsion system and LOX simulation tests performed.

August 31, 1961 thru September 4, 1961 - Measuring calibrations, Ground Support Equipment tests, and engineering changes underway. LOX system and thrust chamber leak checks made.

September 5, 1961 thru September 10, 1961 - Heat exchanger and hydraulic actuator laboratory tests conducted. Hydraulic pressure switches installed and navigation checkout underway. Milestone - Full tank pressurization test completed.

September 11, 1961 thru September 15, 1961 - Canister 15 cable replaced and hydraulic package installed. C-Band radar and Azusa range checks made. Engine curtain installation underway. Network sequence malfunction test conducted. ST-90 platform installed and tested. Facilities checkout underway. Canister cooling and RF Range checks completed. Gas generator installations underway. Milestone - Service structure removed for RF checks. While vehicle ties were disconnected, a squall subjected the vehicle to 55-knot gusts with no adverse effects.

September 16, 1961 thru September 20, 1961 - RF Range checks, with service structure removed, performed. Service structure replaced around vehicle, ST-90 alignment checks performed and navigation system tests underway. Umbilical and cable masts ejection tests performed. Installation of heat shields for engine compartment underway. Overall test Nr. 1 conducted.

September 21, 1961 thru September 25, 1961 - Overall test Nr. 2 conducted. Canister 16 cable replaced. Command receiver tests conducted. Flight control computer checkout underway.

September 26, 1961 thru September 30, 1961 - Bend and twist measurements underway. Heat exchanger and hula-hoop installation underway. Rate gyro aligned. Pressurization test and sphere recovery run conducted. Milestone - Fuel test conducted.

October 1, 1961 thru October 5, 1961 - S-IV and S-V dummy stages loaded with water. Patch panel realignment completed. Launch day set for October 18, 1961. LOX pressurization test and boattail conditioning test completed. Milestone - LOX loading test completed.

October 6, 1961 thru October 10, 1961 - Navigation and platform tests completed. Flight command receivers installed and checked. Telemeter commutation boards installed and checked. Decision made to replace engine Nr. 2. This required rescheduling the launch for October 21, 1961. Milestone - Overall test Nr. 4 completed.

October 11, 1961 thru October 15, 1961 - Destruct circuitry modified as requested by Range. LOX pump seal engine Nr. 2 replaced. Plug drop test completed. Command receiver Nr. 1 exchanged. Primacord, destruct block and turbine spinners fitted and checked. Marotta valves vibration tested. Retract arm valve reworked. Milestone - Engine swivel checks completed.

October 16, 1961 thru October 20, 1961 - Retract arm solenoid checks completed. Telemetry link Nr. 3 replaced. In compliance with MSFC directive, the vehicle launch was rescheduled for October 27, 1961. Milestone - Simulated Flight Test performed with the Range.

October 21, 1961 thru October 26, 1961 - Canister leak test completed. Primacord installation underway. GSE components tests completed. Fueling preparations begun. Milestone - Simulated Flight Test repeated. Prepared for LAUNCH.

October 27, 1961 - LAUNCH.

(U) APPENDIX B

WEATHER

At the time of launch, the following blockhouse observations were recorded:

Precipitation	None
Visibility	10 Miles
Pressure	30.165 Inches (1021.5 mbs)
Temperature	79.1 Degrees F.
Dew Point	66.2 Degrees F.
Relative Humidity	64 Percent
Surface Wind	70 Degrees at 14 Knots with gusts up to 21 Knots

Cloud Conditions

Type	Amount	Height
Cumulus	8/10	41,000 ft.

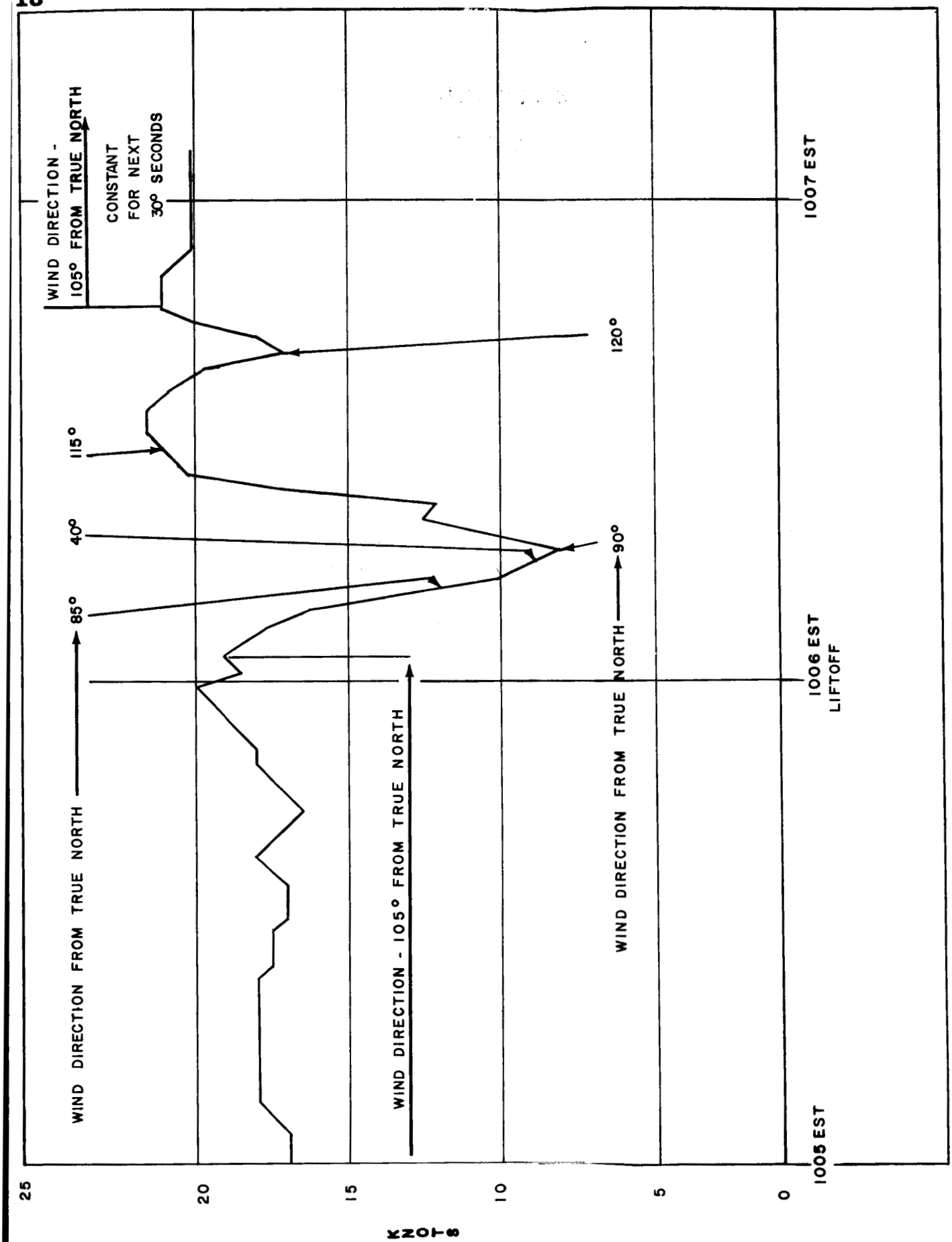


FIGURE 4. WINDS ATOP THE SERVICE STRUCTURE

(U) APPENDIX B
(Continued)

At the time of launch, the following upper air measurements were made for the Launch area.

Altitude (Meters)	Dir. (Degrees)	Velocity (Meters/sec)	Pressure (MBS)	Density	Humidity (Percent)
1500	045	006	858.5	1041.3	76
3250	---	---	694.4	870.3	99
4750	---	---	575.9	747.9	99
6250	---	---	474.0	642.6	99
7750	270	011	387.0	545.0	6
9250	270	017	313.2	462.9	7
10750	249	024	250.6	390.6	16
12250	242	044	198.7	320.0	14
13750	251	037	156.5	259.2	14
15250	247	025	122.5	206.1	99
16750	278	011	95.6	162.3	99
18250	215	006	74.8	125.5	99
19750	170	001	58.9	95.1	99
21500	040	003	44.6	72.7	99
23000	076	002	35.3	55.2	99
24500	269	004	28.1	44.0	99
26000	282	008	22.3	34.9	99
27500	281	011	17.8	27.5	99
29000	266	011	14.2	21.4	99
30500	272	017	11.4	17.2	99

(U) APPENDIX C

FLIGHT TEST RECORDS DISTRIBUTION

Documentary and Engineering Sequential Photographs

Moving pictures and still photographs were taken of various activities during vehicle handling, testing, assembling, and countdown operations between the time the vehicle arrived at Cape Canaveral, Florida and the time of launching the vehicle. The films provide documentary coverage for preparing moving pictures, detailed engineering reports, progress reports, historical reports, unsatisfactory condition reports, and engineering studies. Selected photos are maintained in the files of the Engineering Sequential and Pictorial Coverage Section of the Launch Operations Directorate at Cape Canaveral, Florida. Duplicates and originals are distributed to pertinent organizations for use in films and various reports as required. The originals of both still photographs and motion picture film applicable to news releases are forwarded to the Public Information Offices (PIO) at Marshall Space Flight Center Huntsville, Alabama, and NASA Headquarters, Washington, D.C. Since thousands of feet of moving pictures were made and hundreds of still photographs were taken, no attempt will be made to list the negative numbers or subjects.

Ground Instrumentation Systems Records

The original records obtained by ground instrumentation systems, except those required here at CCMTA, were forwarded to the Saturn Working Group, Marshall Space Flight Center, Huntsville, Alabama.

A copy of the records that could be reproduced are maintained on file in the Data Office of the Launch Operations Directorate at Cape Canaveral, Florida. These records consist of telemetry records, measuring calibration curves, measuring programs, weight records, electronic tracking system records, consolidated data, ECA instrumentation performance records, and optical tracking data.

(U) REFERENCES

1. Report Nr. MTP-AERO-61-72 entitled: "Saturn C-1 Vehicle SA-1 Test Flight Trajectory Corridor to be flown by SA-1", dated August 31, 1961, prepared by MSFC, NASA, Huntsville, Alabama (CONFIDENTIAL).

2. Post Firing Report Saturn SA-1 teletype CCMTA 028C P272110Z Launch Operations Directorate, Titusville, Florida, dated October 27, 1961 (CONFIDENTIAL).

3. Addendum Nr. 1 to the Post Firing Report, Saturn Vehicle SA-1 teletype CCMTA 029C P302040Z Launch Operations Directorate, Titusville, Florida, dated October 30, 1961 (CONFIDENTIAL).

4. Report Nr. IN-M-S&M-E-61-2 entitled: "Final Mass characteristics of Saturn SA-1 Vehicle" (U), dated June 30, 1961 by George C. Marshall Space Flight Center, Huntsville, Alabama.

5. "Operations Directive Nr. 2400 Saturn Launch", dated September 19, 1961 by AFMTC.

6. Report Nr. MTP-M-S&M-E-61-3 entitled: "Saturn SA-1 Vehicle Data Book" (U), dated June 26, 1961 by George C. Marshall Space Flight Center, Huntsville, Alabama. (CONFIDENTIAL)

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TEST RESULTS
PART I
of the
FIRING TEST REPORT
SATURN VEHICLE SA-1

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